PATENT SPECIFICATION

973,995

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International Classification:—F 06 c, f (F 06 j).

COMPLETE SPECIFICATION

DRAWINGS ATTACHED

Ball Joint Assemblies

We, GENERAL MOTORS CORPORATION, a Company incorporated under the laws of the State of Delaware, in the United States of America, of Grand Boulevard, in the City of Detroit, State of Michigan, in the United States of America (Assignees of Thomas Oliver Mathues, Vernon Leonard Pickering and Leo Stephan Sullivan, Jr.), do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to ball joint assemblies which include means for supplying lubricant to the joint, and to resilient covers for excluding dirt from and retaining lubricant within such assemblies.

Increased use of extended lubrication schedules recommended by vehicle manufacturers results in a need for thorough lubrication and preventive maintenance. When lubricant under pressure is supplied to a fitting, it is usual for an ample supply of new lubricant to be introduced, resulting in displacement or purging of used and dirty lubricant previously present in the fitting, which may for example be a ball joint. However, quite often it is difficult to effect displacement of such used and dirty lubricant, and this difficulty can hinder injection of the new lubricant.

This invention in its broadest aspect is a resilient cover for excluding dirt from and retaining lubricant within a ball joint assembly having a lubricant supply fitting, the cover comprising an annular body portion of resilient material adapted to flex at least centrally thereof, and a projection extending integrally from the body portion and terminating in a pair of sealing lip portions which are disposed on opposite sides of a slit made in the projection and which can separate in response to lubricant supply pressure within the cover to permit lubricant to pass outwardly between the lip portions to the exterior of the cover.

The invention also comprises a ball joint assembly comprising a socket portion which receives the head portion of a ball stud and has a lubricant supply fitting projecting therefrom for the supply of lubricant to the joint, the ball stud including a shank portion which projects from the socket portion for attachment to a structural member, and, sealingly interconnecting the socket portion and the shank portion, a resilient cover as aforesaid.

The scope of the monopoly is defined by the appended claims; the invention and how it can be performed are hereinafter particularly described with reference to the accompanying drawings, in which:—

Figure 1 is a plan of one embodiment of a resilient cover in accordance with the present invention;

Figure 2 is a cross-section along the line 2-2 of Figure 1 and shows the resilient cover incorporated in a ball joint assembly in accordance with the present invention;

Figure 3 is a bottom view of the resilient cover shown in Figures 1 and 2;

Figure 4 is a plan of another embodiment of a resilient cover in accordance with the present invention, likewise for use in a ball joint assembly; and

Figure 5 is a cross-section along the line 5-5 of Figure 4.

The ball joint assembly shown in detail in Figure 2 includes a combined resilient cover and one-way valve means integral therewith which is generally indicated by the reference numeral 10.

As best seen in Figures 2 and 3, the combined resilient cover and one-way valve means integral therewith includes a resilient

[Price 4s. 6d.]

annular body portion 11. Integral with this annular body portion 11 are opposite sealing edges including respectively an outwardly extending annular flange 12 and a reduced-diameter inwardly extending edging portion 14 provided with integral inwardly projecting rib-like serrations 15. Embedded in the reduced-diameter edging portion 14 is an annular reinforcing plastics member 16 which is of L-shaped cross-section and has a lower edge extending radially inwardly towards the serrations 15 so as to provide a bottom surfacing 17 for the enhancement of wear resistance and the maintenance of sealing lip pressure. The annular reinforcing plastics member 16 can be made of a mouldable material such as a polyamide resin, or an acetal resin. It is alternatively possible for a low-friction fluorine-containing polymeric material such as polytetrafluoroethylene to be used for the annular reinforcing plastics member 16. The edging portion 14 with the plastics member 16 embedded therein has sufficient rigidity to form a low-flexing area, laterally adjacent to which there is a crescent-shaped radial recess 18 (as indicated in Figures 2 and 3) extending around an integral projection 20 which extends longitudinally in the axial direction from the resilient annular body portion 11. A passage 21 leads from an interior space 23 within the confines of the annular body portion 11 through a passage within the projection 20 to a diametrically transverse slit 22 cut in the base of the projection 20 at a location 24 spaced laterally from a structural mounting member 25 in the form of a vehicle steering knuckle as indicated in Figure 2. The slit 22 in the projection 20 forms a pair of semi-annular sealing lip portions 26 (Figures 2 and 3), which can be caused to separate temporarily to create a restricted opening for the passage of used lubricant from the interior space 23 to the exterior of the body portion 11 of the resilient cover.

Figure 2 shows a complete ball joint assembly incorporating the resilient cover and one-way valve means 10 which has just been described. The ball joint assembly includes a lubricant supply fitting 30 carried centrally relatively to a metal cover portion 31 which has an outer peripheral edge portion 32 attached to one end of an annular housing portion 33 which has a reduced-diameter mounting flange 34 and a central opening 35 adjacent the opposite end thereof. A sintered metal annular bearing means 36 surrounds a sleeve-like low-friction plastics member 37 between an inner periphery of the housing portion 33 and the shank 38 of a ball stud. A hemispherically curved head portion 39 carried by this shank 38 is engageable against a complementarily curved dome-like centre of the cover portion 31. A free end portion of the shank 38 has an externally tapered portion engageable with a mounting hole of the structural mounting 25, and a threaded end engageable by a fastener comprising a nut 40.

The sleeve-like plastics member 37 has an L-shaped cross-section and is fitted axially around the shank 38 such that an integral outwardly extending flange of the member 37 abuts against a shoulder formed along an underside of the curved head portion 39. The member 37 is made of a low-friction plastics bearing material, in this specific instance an acetal resin. Such acetal resin in this sleeve-like member 37 assumes high dimensional stability, tensile and flexural strength resilience and toughness under a wide range of service conditions including high temperature and humidity, and the effects of solvents and stress, and this sleeve-like member 37 of acetal resin allows the ball stud and socket of the ball joint assembly to turn more easily relatively to the sintered metal annular bearing means 36 that engages the curved inner periphery of the socket-like annular housing portion 33.

The resilient cover 10 and one-way valve means extends continuously between the socket-like housing portion 33 and the structural member 25, and allows flexing of the outwardly bowed annular body portion 11 as indicated in Figure 2. A metal band 41 and a wire-like spring retainer 42 serve to anchor the annular flange 12 of the body portion 11 securely to the reduced-diameter mounting flange 34 of the annular housing portion 33. The integral projection 20 can be seen from Figure 2 to be located in an area of the annular body portion at which relatively low flexure occurs, with its axis substantially parallel to the central axis of the annular body portion 11 of resilient material that can bulge or bow laterally outwardly intermediate its ends to accommodate relative movement between the housing portion 33 and the ball stud shank 38.

On the supply of lubricant under pressure to the fitting 30, displacement of lubricant occurs past the part-spherical surface of this bearing means 36, with consequent escape of lubricant through the passage 21 and the slit 22 during temporary separation of the sealing lip portions 26 from each other, the sealing lips subsequently closing to prevent entry of foreign material into the passage 21 by way of the slit 22.

Another embodiment of a combined resilient cover and one-way valve means is generally indicated by the reference numeral 50 in Figure 4. This combined resilient cover and one-way valve means includes an

outwardly bowed flexibly resilient annular body portion 51 provided with a reduced-diameter sealing edge 52 having an annular reinforcing member 53 of L-shaped cross-section embedded therein to enhance surface wear resistance and to maintain sealing lip pressure, and having serrations 54 extending radially inwardly and integrally therewith to be engageable peripherally around a ball stud shank such as is indicated by the reference numeral 38 in Figure 2. A larger diameter flange portion 56 is provided integrally with the resilient annular body portion 51 at a location remote from the reduced-diameter sealing edge 52, this flange portion 56 being adapted to fit complementarily to a ball joint housing portion similar to that indicated by the reference numeral 33 in Figure 2. A one-way valve means is provided integrally with the outwardly bowed annular body portion 51, and includes a lateral projection 60 which extends radially outwardly and has a central passage 61 and a slit 62 cut diametrically therethrough as best seen in Figure 5. The outwardly bowed annular body portion 51 can accommodate considerable flexing due to movement of the ball stud, the ball-like curved head portion of which is retained in a socket. The projection 60 is directed radially away from the stud shank when the body portion 51 is oriented axially and outwardly from the stud shank of such a ball joint assembly. Integrally with the projection 60 there is a pair of sealing lip portions 63 on opposite sides of the slit 62: the sealing lip portions 63 can temporarily flex apart along the slit 62 to facilitate escape of lubricant under pressure from the ball joint assembly, whereby the annular body portion 51 is provided with a sealing one-way valve means which is purgeable to temporarily permit passage of pressurised ball joint lubricant therethrough, the lubricant otherwise being sealingly retained by the body portion owing to engagement of the opposite sealing edges thereof with the socket portion and the stud shank respectively.

WHAT WE CLAIM IS:—

1. A resilient cover for excluding dirt from and retaining lubricant within a ball joint assembly having a lubricant supply fitting, the cover comprising an annular body portion of resilient material adapted to flex at least centrally thereof, and a projection extending integrally from the body portion and terminating in a pair of sealing lip portions which are disposed on opposite sides of a slit made in the projection and which can separate in response to lubricant supply pressure within the cover to permit lubricant to pass outwardly between the lip portions to the exterior of the cover.

2. A resilient cover according to claim 1, wherein the projection extends laterally outwardly from the body portion, which is of outwardly bowed form, with the passage in the projection extending in a radially outward direction.

3. A resilient cover according to claim 1 or 2, wherein the edges of the body portion form sealing edges one of which has a reduced diameter.

4. A resilient cover according to claim 1, wherein the projection is located in an area of the annular body portion at which relatively low flexure occurs and extends with its axis substantially parallel to the central axis of the annular body portion.

5. A resilient cover according to claim 4, wherein the edges of the body portion form sealing edges one of which has a reduced diameter.

6. A resilient cover according to claim 4 or 5, wherein the body portion includes an inwardly extending end portion which terminates in integral sealing ribs, and a reinforcing annular plastics member of L-shaped cross-section is embedded in the end portion radially inwardly of a crescent-shaped recess extending around the projection.

7. A resilient cover for excluding dirt from and retaining lubricant within a ball joint assembly having a lubricant supply fitting, substantially as hereinbefore particularly described and as shown in Figures 1 to 3 of the accompanying drawings.

8. A resilient cover for excluding dirt from and retaining lubricant within a ball joint assembly having a lubricant supply fitting, substantially as hereinbefore particularly described and as shown in Figure 2 as modified by Figures 4 and 5 of the accompanying drawings.

9. A ball joint assembly comprising a socket portion which receives the head portion of a ball stud and has a lubricant supply fitting projecting therefrom for the supply of lubricant to the joint, the ball stud including a shank portion which projects from the socket portion for attachment to a structural member, and, sealingly interconnecting the socket portion and the shank portion, a resilient cover according to any one of claims 1 to 6.

10. A ball joint assembly substantially as hereinbefore particularly described and as shown in Figures 1 to 3 of the accompanying drawings.

11. A ball joint assembly substantially as hereinbefore particularly described and as shown in Figure 2 as modified by Figures 4 and 5 of the accompanying drawings.

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Chartered Patent Agent.

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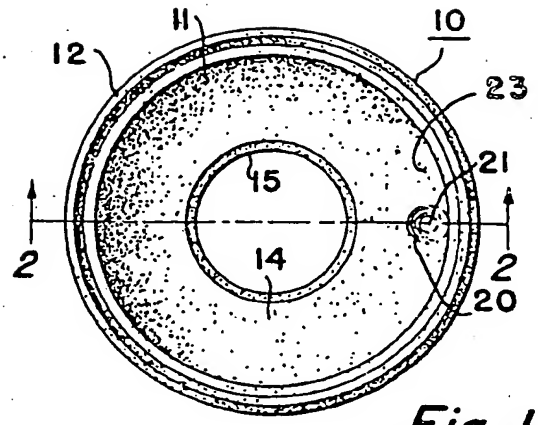
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Fig. 1

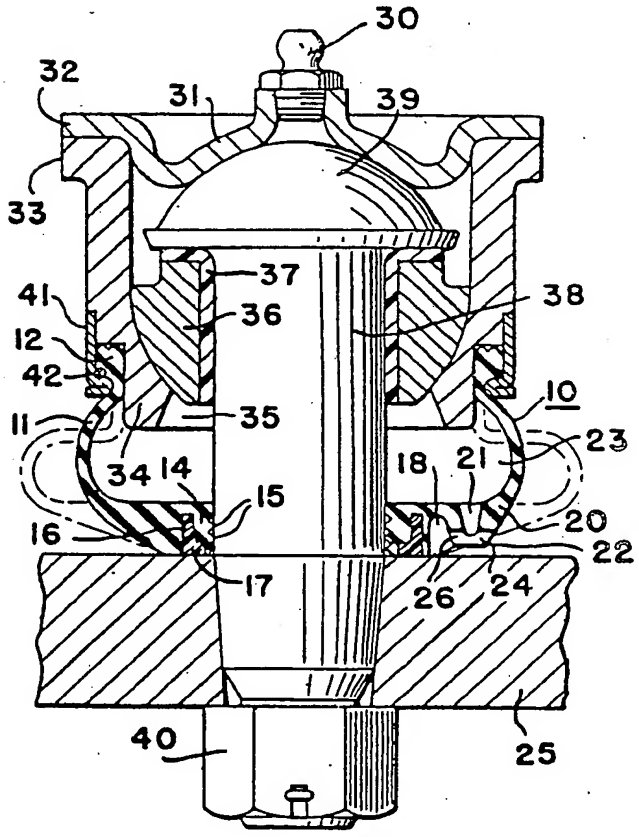
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Fig. 2

973,995 COMPLETE SPECIFICATION
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SHEETS 1 & 2

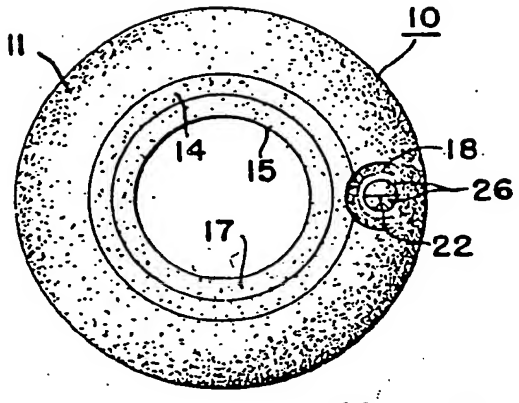

Fig. 3

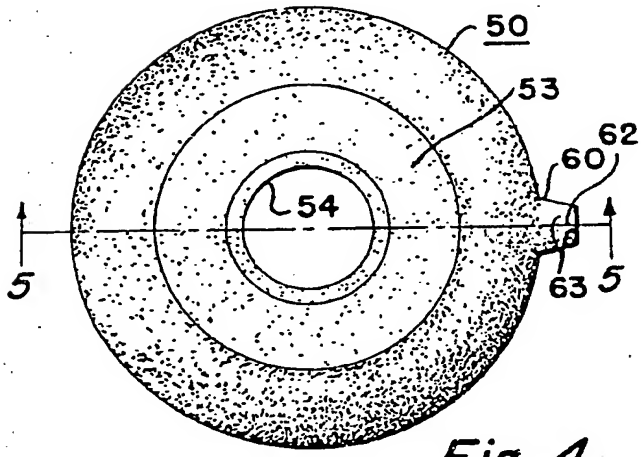

Fig. 4

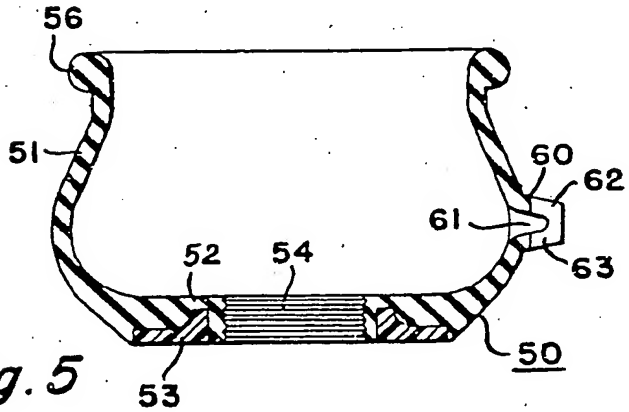

Fig. 5

973,995 COMPLETE SPECIFICATION
2 SHEETS This drawing is a reproduction of the Original on a reduced scale.
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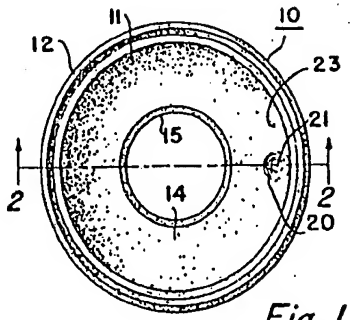

Fig. 1

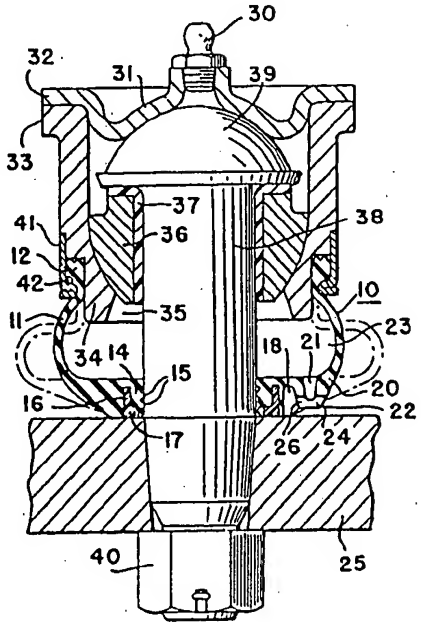

Fig. 2

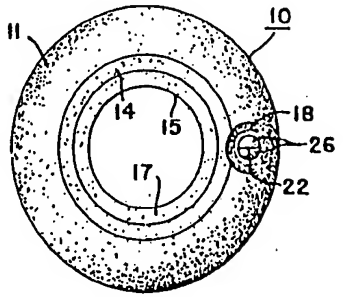

Fig. 3

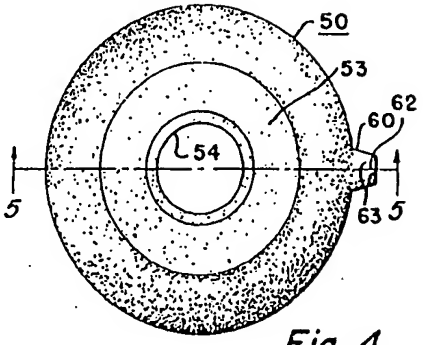

Fig. 4

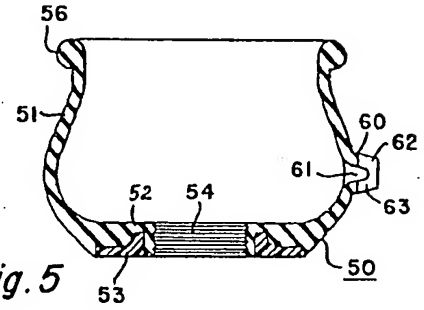

Fig. 5